

# Approaches to Adoption of Laboratory LOINC in Taiwan

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## Interoperability

- **interoperability** : *ability of two or more systems or components to exchange information and to use the information that has been exchanged.*
- **Source: IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries, IEEE, 1990]**

Acknowledgement to George W. Beeler, Jr.

## **Semantic interoperability**

**To understand the data being received you must know both:**

- 1. The definition of each element of data, and its relationship with each of the other elements – you must have a semantic model of the data  
and**
- 2. The terminology to be used to represent coded elements, including the definitions, and relationships within the terminology.**

**Acknowledgement to George W. Beeler, Jr.**

**Adoption of LOINC codes for clinical  
laboratory tests**

**a step toward global interoperability  
of patient laboratory information**

## Overview of health informatics projects in Taiwan

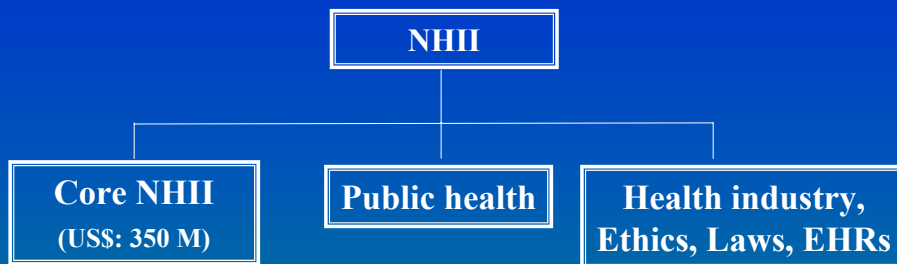


Invest NT\$15 billion (US\$ 500 million) within 5 years (2005-2010) to

- establish an integrated bio-pharmaceutical infrastructure, and
- develop a “genomics research base” and “clinical research center”

*From Council for Economic Planning and Development, MOE, 2005/04/06*

## The Components of NHII



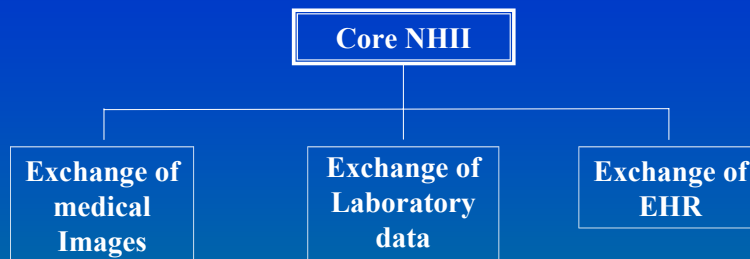
**Overall goals:**

- Establish standards for exchange of EHR nationwide
- Facilitate 1 million outpatients and 80,000 inpatients per day to exchange their EHR among hospitals in real-time

## The implementation of phases of Core NHII

- Phase 1 (2005 - 2006)  
Exchange of medical images between large scale of hospitals (ie., medical centers and regional hospitals)
- Phase 2 (2005-2008)  
Exchange of laboratory data (regional hospitals and ↑ )  
Exchange medical images (district hospitals and ↑ )
- Phase 3 (2009)  
Exchange of laboratory data (district hospitals and ↑ )  
Implementation of portability of EHR among hospitals (all levels)

## Government Special Budget allocation



unit : NT\$ million

Fiscal Year	2005	2006	2007	2008	Total
Expected special budget	898	1,947	2,544	3,515	8,904
Actual budget	250 (30%)	73 (4%)	negotiating	unknown	

## **Adoption of LOINC codes for clinical laboratory tests**

**is a component of core NHII project, & has been supported by the Department of Health, Taiwan since 2004.**

## **Why LOINC ?**

- **Laboratory tests in Taiwan are named and coded on an individual hospital basis (local codes).**
- **Pooling of patient data from different resources can reduce medical cost and improve patient safety**
- **The need for exchange of laboratory results between hospitals**
- **LOINC is free and adopted by US and internationals**

## NHI codes are accepted healthcare standards

- National Health Insurance (NHI) Codes are commonly used in Taiwan, but cannot support the requirements for clinical care.

Num	Description/component	Primary care provider	District hospital	Regional hospital	Medical center	Pay counts
09005C	血液及體液葡萄糖 BLD/FLU Glucose , note: exclude urine	v	v	v	v	50

NHI codes ( like CPT, AMA Current Procedural Terminology)

➔ **Need of a coding standard for exchange of clinical laboratory tests**

**Our approach:**  
take advantages of NHI codes to facilitate adoption of LOINC codes:

- ✓ Create a NHI-LOINC mapping database
- ✓ Map local codes to NHI codes, (existing)
- ✓ Map NHI codes to LOINC codes thru NHI-LOINC database

# Use RELMA to create NHI-LOINC database

## RELMA (Regenstrief LOINC Mapping Assistant)

Local Words

Item #	LOINC #	Short Common Name	Component	Property	Units	System	Class	Type
1	35001-7	ABNORMAL	ABNORMAL	CC	PT	REG	QSP	Q
2	35002-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
3	35003-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
4	35004-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
5	35005-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
6	35006-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
7	35007-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
8	35008-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
9	35009-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
10	35010-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
11	35011-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
12	35012-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
13	35013-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
14	35014-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q
15	35015-7	ABN	ABNORMAL	CC	PT	REG	QSP	Q

## NHI-LOINC database

NHI	LOINC	SHORTNAME	COMPONENT	Property	Time	System	Scale	Method
09001C	12183-0	Cholest Fld-mCnc	CHOLESTEROL	MCNC	PT	FLU	QN	
09001C	14438-6	Cholest Amn-mCnc	CHOLESTEROL	MCNC	PT	AMN	QN	
09001C	14439-4	Cholest CSF-mCnc	CHOLESTEROL	MCNC	PT	CSF	QN	
09001C	14441-0	Cholest Prt-mCnc	CHOLESTEROL	MCNC	PT	PRT	QN	
09001C	14442-8	Cholest Smn-mCnc	CHOLESTEROL	MCNC	PT	SMN	QN	
09001C	14443-6	Cholest Snv-mCnc	CHOLESTEROL	MCNC	PT	SNV	QN	
09001C	14444-4	Cholest Ur-mCnc	CHOLESTEROL	MCNC	PT	UR	QN	

### One to many mappings:

$\underbrace{\langle[\text{analyte}].[\text{subclass}].[\text{sub-subclass}]\rangle^{\wedge}}_{\text{principal name}}$			$\underbrace{\langle[\text{time delay}] \text{post} [\text{amount}] [\text{substance}] [\text{route}]\rangle^{\wedge}}_{\text{challenge}}$			$\underbrace{\langle[\text{adjustment}]\rangle^{\wedge}}_{\text{adjustment}}$		
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## Detailed NHI-LOINC mappings

### ◆ 1<sup>st</sup> version of NHI-LOINC database (2005/07/31)

#### Laboratory NHI-LOINC mapping

	Urine Test	Stool Test	Hematology Test	Biochemistry	微量元素	Virology	Pre-transfusion test	Immunology	Bacteriology & Fungus	Total tests
NHI codes	25	14	81	87	38	17	15	120	13	410
Successful mapping	22	13	78	80	38	17	15	107	13	383
unsuccessful mapping	3	1	3	7	0	0	0	13	0	27
Map to LOINC	525	101	662	1306	441	151	78	1062	346	4672
Success mapping %	88.00	92.86	96.30	91.95	100.00	100.00	100.00	89.17	100.00	93.41

◆ 2<sup>nd</sup> reversion of the database (2006/09/30): 8760 records, including virology exam, fluid exam, loading test, tube method, allergy tests



**Develop a web-based NHI-LOINC  
Mapping Assistant System (NLMAS )**

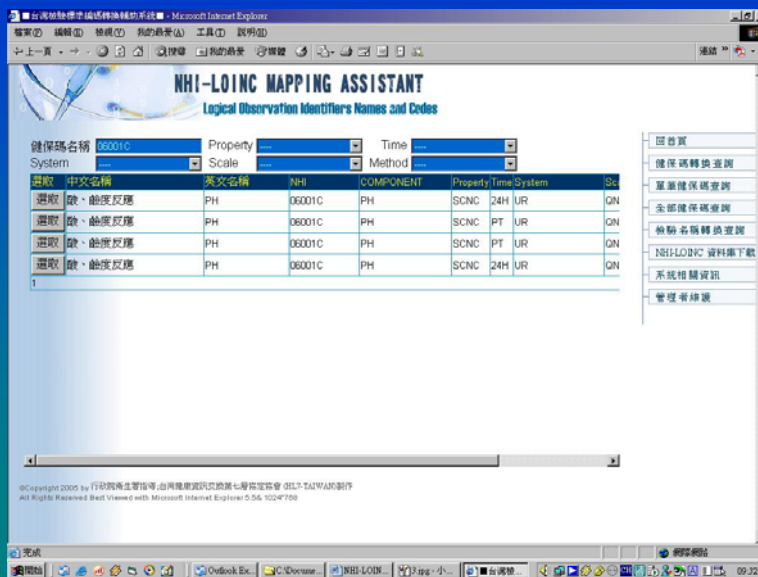
**The NLMAS provides services:**

- **NHI code mapping**
- **Laboratory name mapping**
- **NHI-LOINC DB download**

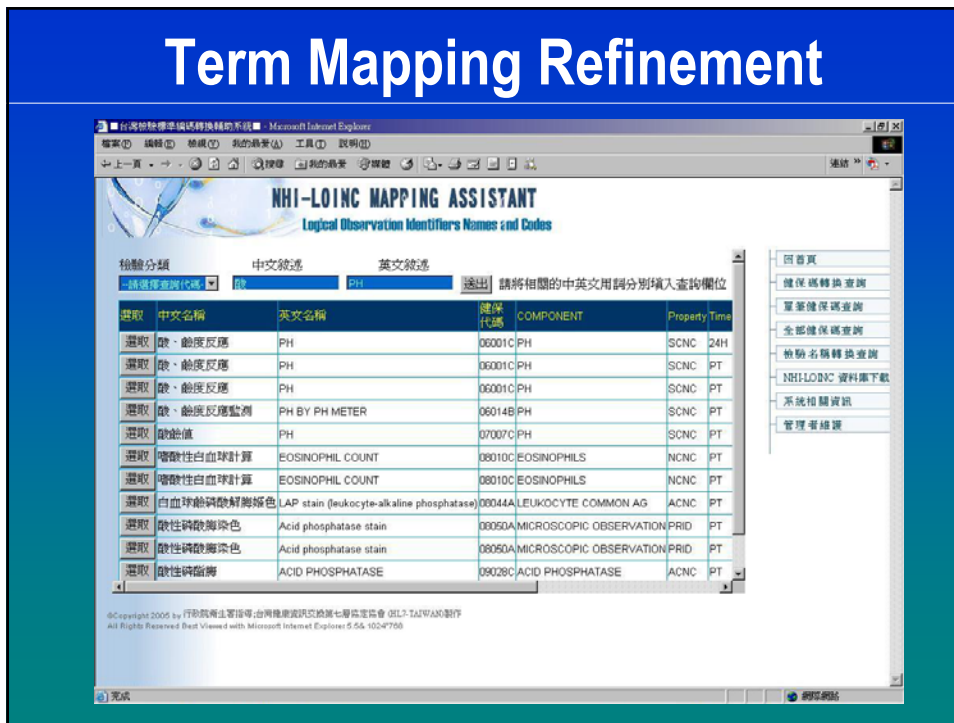
<http://loinc.doh.gov.tw/>



## NHI Mapping Refinement



# Term Mapping Refinement



## Evaluation

Using NHI-LOINC DB to map laboratory local codes to LOINC codes

Hospital	Successful mapping		Unsuccessful mapping		Total
	# of items	%	# of items	%	
A	328	75.8	105	24.2	433
B	600	80.1	149	19.9	749
	928	78.6	253	21.4	1182

Most unsuccessful mapping items are self-paid tests, *i.e.*, not covered by NHI

## Conclusions

- ❖ Due to familiarity of National Health Insurance codes, the NHI-LOINC DB can reduce the learning curve and required domain knowledge, and hence, can facilitate the adoption of LOINC codes in Taiwan.
- ❖ NLMAS is maintained by HL7 Taiwan and sponsored by DOH
- ❖ At present, RELMA is still a necessary tool for the mapping.
- ❖ Laboratory name mapping can be further enhanced to provide a unified mapping from local to LOINC

## Future Work

### ◆ Enhance laboratory name mapping (e-NLMAS)

#### Original term mapping DB (from LOINC DB)

2351-5	{GLUCOSE, MRAT, 24H, UR, QN, Glu, Gluc, Glucoseur, mRate, Mass, rate, 1, day, 24, hours, 24HR, Urine, Urn, UA, Quantitative, QNT, Quant, Quan, CHEMISTRY}
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NHI Laboratory term mapping



Chinese/English laboratory terms mapping

## Examples of Chinese/English Laboratory name mapping

Term	LOINC-1	LOINC-2	LOINC-3	LOINC-4	LOINC-4, .....
17-hydroxycorticosteroids	14568-0	1664-2	1665-9	1666-7	21036-9, .....
17-KS (17-ketosteroids)	12769-6	14572-2	21038-5	25317-9	29353-0, .....
17氫氧根腎上腺酮	14568-0	1664-2	1665-9	1666-7	21036-9, .....
17酮類固醇類	12769-6	14572-2	21038-5	25317-9	29353-0, .....
C反應性蛋白試驗-免疫比濁法	11039-5	14634-0	16503-5		
C反應性蛋白試驗-免疫擴散法	11039-5	14634-0	16503-5		
C反應性蛋白試驗-乳膠凝集法	11039-5	14634-0	16503-5		
D型木糖吸收試驗	12274-7	25556-2	29999-0		
H血紅素染色體檢查	17871-5				
A1- 抗胰蛋白酶-免疫比濁法	12466-9	1825-9	25303-9	29146-8	6771-0, .....
A1- 抗胰蛋白酶-單幅射擴散法	12466-9	1825-9	25303-9	29146-8	6771-0, .....

## Future work

- ❖ Enhance the e-NLMAS to support a unified approach for local mappings
- ❖ one hospital has joined pilot project for exchange lab data using LOINC in 2006 .
- ❖ there will be 7 (hospitals or clinical laboratory centers) more in 2007
- ❖ Encourage Taiwan CDC to adopt LOINC for laboratory reporting and surveillance

**HL7 Taiwan**

**Thank you!!**

*[www.hl7.org.tw](http://www.hl7.org.tw)*

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